AFRICAN-AMERICAN AND WHITE LIVING STANDARDS IN THE 19TH CENTURY AMERICAN SOUTH: A BIOLOGICAL COMPARISON

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Abstract

By using a new source of 19th century Texas state prison records, the present study contrasts the biological living conditions of comparable blacks and whites in the American South between the Civil War and Reconstruction. White stature exceeded black stature. Between 1850 and 1870, black sub-adult stature declined by over one centimeter. Postbellum sub-adult white stature declined by over one and a half centimeters and never recovered over the same period. The secular trend for adult blacks improved by two and one half centimeters between the 1850s but declined after the Civil War.

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African-American and White Inequality in the 19th Century American South: a Biological Comparison

I. Introduction

While much has been written on the legal and socioeconomic status of African-Americans between the Civil War and World War I, less is known about their biological living conditions over this period. Moreover, little is known about how 19th century political and economic events influenced the biological living conditions among comparable lower class blacks and whites in the American South, those most vulnerable to political and economic change. When brought to maturity under similar biological conditions, blacks and whites should reach comparable adult terminal statures. [1] However, comparison of 19th century blacks and whites in the American South indicates that blacks were physically shorter than whites. By using a new source of 19th century Texas prison records, the present study contrasts male biological living conditions of comparable blacks and whites in the American South between the Civil War and First World War.

A populations' average stature reflects the cumulative interaction between nutrition, disease exposure, work and the physical environment. By considering average versus individual stature, genetic differences are mitigated, leaving only the influence of the economic and physical environments on stature. When diets, health or physical environments improve, average stature increases and decreases when diets become less nutritious, disease environments deteriorate or the physical environment creates more

[1] Eveleth and Tanner, *Worldwide Variation in Human Growth.* Appendix. Tables 5, 29, and 44; Tanner, "Factors Controlling Growth," pp. 341-342; Margo and Steckel, "Heights of American Slaves".

stress on the body. Hence, stature provides significant insights into understanding historical processes and augments other welfare measures between 19th century blacks and whites in the American South.

The existing literature on 19th century black and white biological living conditions indicates that inequality and poverty extended to biological well-being. Margo and Steckel demonstrate that adult male slaves were shorter than northern whites, and slaves born in the New South may have fared better than slaves in the Old South.[2] There were also significant stature variations among slaves over time; slaves born between 1790 and 1810 were shorter than slaves born before 1790 and after 1810. Moreover, slaves and free blacks' biological living conditions did not demonstrate the 'Antebellum Paradox' observed in other 19th century white samples, where wages and wealth monotonically increased while average stature decreased.[3] Nevertheless, black average stature varied by occupation; black unskilled workers and field hands were taller than domestic and skilled slaves.[4] Part of these occupational stature differentials may have come from taller slaves' comparative advantage in skilled occupations and field work.[5]

An extensive literature on the biological living standards of 19th century whites living in America has provided numerous insights. Several studies suggest that white average stature declined throughout the 19th century's 2nd and 3rd quarters, even though wages and output per capita were increasing.[6] Moreover, white biological living

[2] Margo and, "Heights of American Slaves," p. 519.
[3] Komlos, "Shrinking in a Growing Economy?" p. 58.
[4] Margo and Steckel, p. 525; Cuff, "Historical Anthropometrics."
[5] Metzer, "Rational Management," p. 134.
[6] Komlos, "Shrinking in a Growing Economy?" pp. 780-81; Komlos, and Coclanis. "On the Puzzling Case of Antebellum Georgia." p. 439. Steckel, "Stature and the Living Standard." pp. 1919-1921.

conditions were sensitive to American occupations and nativity.[7] Rural farmers consistently benefited from rural environments relative to their urban counterparts.[8] Residents of America's Northeast were generally shorter than other Americans, while residents in the South, Plains and Far West reached taller average statures.[9]

It is against this backdrop that this paper considers the 19th century biological living conditions of black and white inmates in the Texas State Prison. A sample of over 42,000 black and white male inmates from the Texas prison is introduced which covers the period from slavery through Reconstruction and the end of the 19th century.[10] Two issues are considered. First, how did the period from slavery through Reconstruction influence the biological living standards of both blacks and whites in the American South? The Texas prison population is particularly interesting because prison inmates are representative of the poor, working class, that segment of society most vulnerable to economic change.[11] Did changes in biological living conditions persist after controlling for demographic, occupational and birth-period effects? If stature differences persisted after controlling for age, nativity, birth cohort, and socioeconomic status, stature differences may have been attributable to distinctively Southern institutional arrangements. Second, the Texas prison population is segregated by age to determine how demographics and socioeconomic status influenced black and white biological living

[7] Margo and Steckle, "Heights of Native Born Northern Whites," pp. 171-172; Vilaflour and Sokoloff, "Early Achievement," p. 465.
[8] Komlos and Coclanis, "On the Puzzling Case of Antebellum Georgia." p. 441; Steckel and Haurin. "Health and Nutrition in the American Mid-West." p. 123; Margo and Steckel "Heights of Native-Born Whites." p. 170; Sokoloff and Vilaflour, "Early Achievement," p. 463.
[9] Steckel, Richard. "Stature and the Living Standard", p. 1921; Steckel. "Health and Heights in the United States." pp. 158-59.
[10] The total number of inmates recorded in the Texas prison between 1873 and 1922 is over 50,000. This includes nearly 8,000 observations of Mexicans, females, and Europeans not considered here. Carson, "The Biological Standard of Living in Mexico and the American West," 2005.
[11] Margo and Steckel, "Heights of American Slaves," p. 519. Modern studies demonstrate that well-fed Americans of African descent reach approximately the same statures as Europeans and Americans of European descent; hence, variation in genetics may play minor roles in black-white stature differentials.

conditions. Did black and white statures respond the same to changes in socioeconomic conditions and nativity or were changes between the two groups somehow different? Section 2 introduces the 19th century Texas state prison records; incarceration processes may have disproportionately incarcerated blacks relative to whites, especially by gender. Section 3 examines how black and white statures changed over time. Section 4 considers how socioeconomic and regional effects were related to black and white stature. Section 5 places black and white stature cycles into 19th century historical perspective.

II. Data

In the late spring of 1849, the Texas State Penitentiary at Huntsville finished its first cell block; however, it was not until later that year that the first inmates entered the prison. The inmate population grew slowly at first, and State Governor, Peter H. Bell, soon requested funds to build a cotton and woolen mill where inmate labor could be used in cotton and wool manufacturing, helping defray prison operating expenses. By the eve of the Civil War, prison administrators enlarged the mill's capacity to process 500 bales of cotton and 6,000 pounds of wool annually. Civil War earnings from the mill proved to be significant, and military and civilian sales contributed to Texas state government revenues. Moreover, postbellum lawlessness required a rapid expansion in prison capacity to accommodate Texas' growing criminal element and prison population.[12] The state remedied this capacity constraint by turning idle inmate time into to a convict lease system, where the state entered contractual arrangements with private citizens, contracting out prisoners to work on private farms or other such economic endeavors.[13] Prisoners not rented out remained behind on prison grounds to construct new cellblocks

[12] Crouch, "Spirit of Lawlessness."
[13] Monkkonen, *Crime, Justice, History*, p. 36; Friedman, *Crime and Punishment in American History,* p. 156 indicates that 19th century convict lease systems were common, especially in the American South.

and workshops. Thus, like other 19th century American prisons, the Texas state system evolved slowly, following a patchwork construction arrangement until a more concrete state penitentiary system was developed.[14]

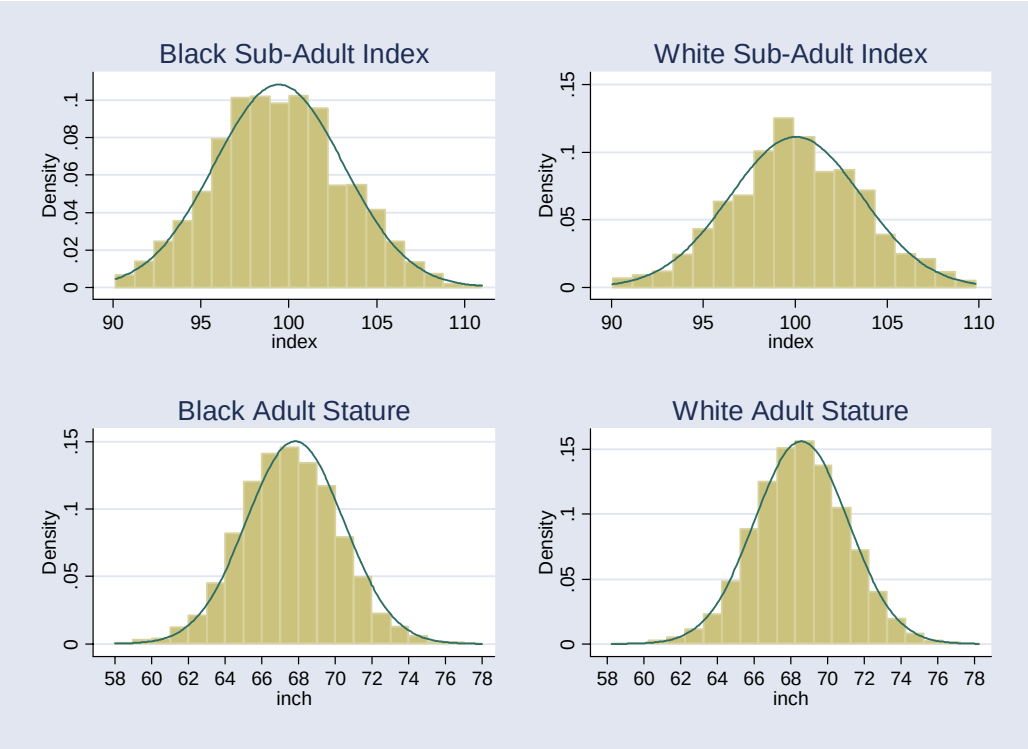
Between 1873 and 1920, prison guards routinely recorded the dates inmates were received, age, complexion, nativity, stature, pre-incarceration occupation and crime. Fortunately, inmate enumerators were quite thorough when recording inmate complexion and occupation.[15] For example, enumerators recorded black inmates' race in a complexion category as black, light black, dark black or various shades of mulatto.[16] While mulatto inmates possessed genetic traits from both European and African ancestry, they were treated as blacks in the American South and are grouped here with black inmates.[17] Enumerators recorded white inmate complexion as light, medium and dark. The white inmate complexion classification is further supported by the complexion of European immigrants, who were always of fair complexion and were also recorded as light, medium and dark. Enumerators recorded a broad continuum of occupations and defined them narrowly, recording over 200 different occupations. These occupations are classified here into four categories. Workers who were merchants and high skilled workers are classified as white-collar workers; manufacturing and construction workers are classified as skilled workers; workers in the agricultural sector are considered as

[14] "Texas State Penitentiary at Huntsville."
[15] Although the Texas Prison data set allows access to a large and valuable set of inmates of Mexican nativity residing in Texas, the focus of this paper is the comparison between white and black inmates.
[16] Like Komlos and Coclanis, "Puzzling Cycle," inmates with complexions recorded as black, brown, copper, dark brown, dark mulatto, ginger, light brown, light mulatto, mulatto and yellow are considered as black. Inmates with complexions recorded as fair, florid, dark, light, ruddy, sallow, sandy and swarthy are considered as from European ancestry.
[17] While some studies in 19th century African-American anthropometric history find a "mulatto advantage," there is little evidence that farer skinned African-Americans in the Texas prison had a distinct stature advantage over darker skinned African-Americans.

farmers; laborers are considered as unskilled workers.[18] By having the same prison official record characteristics over much of the period, the consistency of the Texas prison sample creates reliable comparisons across race and time.

A vital distinction in anthropometric studies is between adult and sub-adult stature.[19] The average stature of adults older than 22 and younger than 56 reflects nutritional advantages and disadvantages during childhood, less environmental conditions, disease insults and calorie claims for work. Sub-adult stature is even more sensitive to immediate changes in nutritional, environmental and disease environments because older adults may undergo catch-up growth;[20] variation in sub-adult stature is more likely due to immediate conditions.[21] Because the immediate effects of age on stature are different between sub-adults and adults, they are considered separately here.

[18] Prison guards who recorded occupation did not distinguish between farm and common laborers. This potentially overestimates the biological benefits of being a common laborer and underestimates the advantages from being a farm laborer, since common laborers typically came to maturity under less favorable biological living conditions. The occupation classification system used here replicates that used by Ferrie (1997, 325; 1999). See the appendix for the occupation classification system used here.
[19] Johnston, F.E. and L. O. Zimmer, "Assessment of Growth and Age,"; Saunders, S.R. "Sub-adult Skeletons".
[20] Bogin, *Patterns of Human Growth.*
[21] Goodman, and Martin, "Reconstructing Health Profiles," p. 19.



	Mean	*Median*	*Standard Deviation*	*Skewness*	*Kurtosis*
Black, Sub-Adult	67.0	67.0	2.9	-.312	4.2
Index	99.37	99.24	3.95	-.068	3.63
White, Sub-Adult	68.0	68.0	2.7	-.126	3.8
Index	100.00	99.96	3.80	-.101	3.65
Black, Adult	67.8	68.0	2.7	-.072	3.8
White, Adult	68.5	68.5	2.6	-.086	3.4

Figure 1, Black and White, Sub-Adult and Adult Stature Comparison

One common shortfall of many military samples is a truncation bias imposed by minimum stature requirements. Fortunately, prison records do not implicitly suffer from such a constraint and the subsequent truncation biases observed in military samples. Because the height distribution of sub-adults is itself a function of the age distribution, a sub-adult stature index is constructed that standardizes for age to determine sub-adult stature normality. First, the average stature for each sub-adult age category is calculated. Second, each observation is then divided by the average stature for the relevant age group.[22] Figure 1 demonstrates that black and white statures were distributed approximately normal.

III. The Black and White Secular Trends

The timing and extent of stature variation reflects the cumulative relationship between diet and disease, but also the distribution of wealth, population change, sectoral shifts in production, and migration.[23] In the 19th century American South, changes in black and white stature may have also reflected changes in social, legal and economic structures. To account for possible compositional effects and to determine how demographic and socioeconomic characteristics were related to stature, the Texas prison sample is partitioned by age and complexion. Two age groups are considered: sub-adults and adults. Table 2 regresses individual black and white stature on observable characteristics. Models 1 and 2 regress black and white sub-adult statures on age, occupations, birth periods and inmate nativity. Models 3 and 4 do the same for black and

[22] Komlos, "West Point Cadets," p. 899.
[23] Steckel, "Heights and Health in the United States," p. 16; Lynch, John and George Kaplan, "Understanding How Inequality in the Distribution of Income Affects Health," pp. 305-308, addresses how inequality impacts human health.

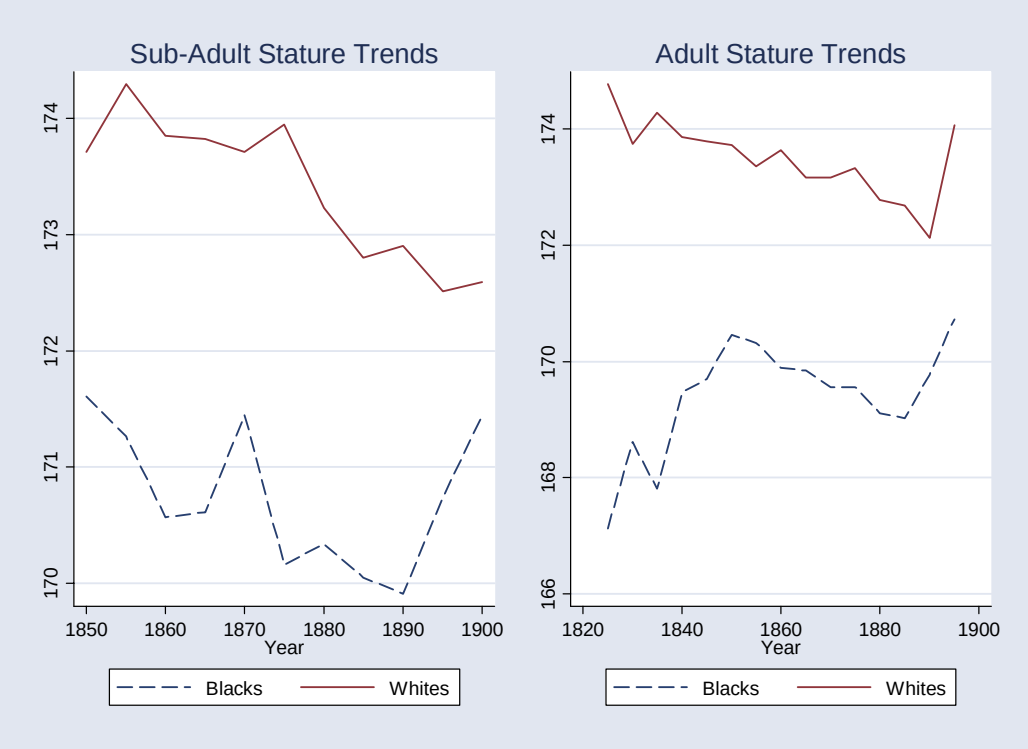
white adults. Figure 2 isolates changes in the black and white secular trends by using time coefficients in Table 2.

Table 2, Black and White, Sub-Adult and Adult, Stature Models

Sub-Adults	Black	White	*Adults*	Black	White
Intercept	171.61*	173.71*	Intercept	169.89*	173.64*
Age 15	-7.89*	-9.86*	White-Collar	.204	1.23*
Age 16	-5.37*	-4.96*	Skilled	.909**	1.04*
Age 17	-2.87*	-2.95*	Farmer	.789**	1.58*
Age 18	-1.85*	-1.98*	Unskilled	.538	1.69*
Age 19	-.953*	-1.18*	1820	-2.77*	1.13
Age 20	-.142	-.149	1830	-1.28**	.108
White-Collar	.282	.557	1835	-2.08*	.635
Skilled	.983	.198	1840	-.428	.226
Farmers	1.60*	1.88*	1845	-.191	.144
Unskilled	.900***	.669***	1850	.565**	.081
1855	-.343	.584	1855	.431**	-.286
1860	-1.04	.142	1865	-.047	-.471***
1865	-.996	.112	1870	-.333	-.478***
1870	-.1.62**	.001	1875	-.330***	-.316
1875	-1.45***	.236	1880	-.784*	-.858*
1880	-1.27**	-.480	1885	-.868*	-.952*
1885	-1.56**	-.907	1890	-.120	-1.51*
1890	-1.70**	-.807	1895	.835***	.421
1895	-.874	-1.20	Northeast	.518	-.825
1900	-.162	-1.12	Middle Atlantic	-.776***	-2.86*
North East	.736	-1.87	Great Lakes	.553	-1.09*
Middle Atlantic	-1.42	-2.78*	Plains	.723***	-.796*
Great Lakes	-1.69	-1.72*	Southwest	2.22*	.065
Plains	-1.82	-.704***	Far West	-1.23	-1.36**
Southwest	1.05	.492	Migrant	1.44**	-.484
Far West	.711	-1.18	N	17,802	11,247
Migrant	.218	.487	R^2	.0095	.024
N	8,775	4,468			
R^2	.0860	.0878			

Note: Stature is in centimeters. Sub-adults are age 21 and less. The omitted sub-adult category is 21 year olds, born in the 1850s, with no occupation from the Southeastern United States. Adults are age 22 through 55. The omitted adult category is no occupation, born in the 1860s from the Southeastern United States.
*, Significant at .01.
**, Significant at .05.
***, Significant at .10.

Figure 2, Average Texas Inmate Stature by Complexion



Note: Stature patterns determined using time coefficients in Table 2.

Two general patterns emerge when comparing black and white secular trends over time. First, it is striking the degree to which white average stature exceeds black stature.[24] This is even more significant since modern statures of whites and blacks are comparable when brought to maturity under similar biological circumstances.[25] Part of these black and white stature differences were related to nutrition,[26] exposure to less virulent disease environments, and more strenuous work environments encountered by blacks. According to Margo and Steckel, before the War, much of this disparity originated in slave diets and the feeding practices of slave masters, which was to wean

[24] Margo, and Steckel "Work, Disease and Diets," pp. 514-515, 517 and 519, find that southern whites were nearly 2 inches taller than southern blacks, and that compositional effects can not explain the difference; Margo, Robert, and Richard Steckel, "Heights of American Slaves," p. 519.
[25] Eveleth and Tanner, *Worldwide Variation in Human Growth.* Appendix. Tables 5, 29, and 44; Tanner, "Factors Controlling Growth," pp. 341-342; Margo and Steckel, "Heights of American Slaves," p. 519.
[26] Margo and Steckel, "Nutrition and the Health of Slaves and Southern Whites," p. 517, find that part of the white stature advantage was due to their access to meat.

slave children to a diet high in carbohydrates and low in protein.[27] This weaning process further exposed slave children to unsanitary feeding implements and contaminated, starchy diets.[28] Slave children's diets consisted mostly of cornbread, hominy and fat.[29] This high intake of carbohydrates and low intake of protein meant that slave children had grossly deficient diets that were calorie abundant.[30] Moreover, many of the physical symptoms of slave children recorded on plantations were consistent with rickets, kwashiorkor and marasmus, related to the inadequate consumption of calories and proteins.[31] Slave children were fortunate to consume meat allocations—which were mostly fat—within families in proportion to the plantation work they performed.[32] Slave children also fared poorly as they approached adulthood because parents and working adults had higher dietary priorities than children and consumed meat and other nutrients at the expense of children. After slavery, free black diets were low in protein and lacked essential amino acids.[33] Consequently, sub-standard 19th century black diets and nutrition account for part of the shorter statures of blacks to whites.

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[27] Ibid. 288.
[28] Steckel, "A Peculiar Population," p. 732.
[29] Kiple and Kiple, "Slave Child Mortality," p. 288.
[30] Ibid. pp. 289, 296; Coclanis and Komlos, "Southern Nutritional and Economic Development," p. 107, also indicates that southern slave diets were high in fates and carbohydrates but low in minerals, vitamins and proteins.
[31] Rickets is a nutrition deficiency disease that effects the young during the period of skeletal growth. Rickets is characterized by soft and deformed bones and is caused by the failure to assimilate and use calcium and phosphorous normally due to inadequate sunlight or vitamin D. Kwashiorkor is caused by severe malnutrition in infants and children that is caused by a diet high in carbohydrates and low in protein. Marasmus is progressive emaciation, especially in children undernourished because of a diet deficient in calories and proteins. Slave children's diets were also deficient in calcium, magnesium and iron, which may have contributed to their diminished statures (Kiple and Kiple,pp. 288, 293-294). Under slavery, black and white diets were adequate in calories, however, lacked nutritional content relative to work expenditures (Fogel and Engerman, *Time on the Cross*, p. 112, Table 33; Fogel, *Without Consent or Contract*, pp. 132-138; Higgs, *Competition and Coercion*, p 105). There is also evidence that slave diets were not high in calories from meat, and the quality of meats consumed by slaves were lower than the quality of meats consumed by whites.
[32] Higgs, *Competition and Coercion*, p. 105, indicates that blacks mean consumption during Reconstruction were mostly of high fat cuts of meat.
[33] Higgs, *Competition and Coercion.* pp. 106-107.

Diseases were also a constant threat to both black and white's biological progress.[34] Poor diets and inadequate public health systems contributed to virulent Southern disease climates.[35] Endemic Southern diseases included malaria, typhus, diphtheria, and smallpox, which impeded both black and white sub-adult stature gains during critical growing years but disproportionately affected black children.[36] Blacks were less likely to have shoes, therefore, more likely to contract hookworm, and because of their low incomes, blacks were more likely to live in the worst malaria ridden areas where respiratory and infectious diseases were more prevalent. Moreover, part of the noted diminished stature among blacks may be related to blacks' biological adaptation to their forced migration to the New World.[37] In Western Africa— where most slaves originated— darker skin pigmentation helped to keep blacks cool and protected them from skin damage. However, after their forced migration to more northerly climates, darker pigmentation inhibited their skin's synthesis of vitamin D and provoked severe rickets and malnutrition.[38] These biological liabilities led to anemia, which increased dietary requirements and reduced calories available for human growth.[39] Thus, the combination of inadequate Southern nutrition allocated to children and virile disease

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[34]In the March 2000 *Journal of Economic History*, Coelho, McGuire and Steckel discuss the relative merits of diets vs. disease in explaining 19th century statures and stature variation. Although there is contemporary evidence that disease may influence stature (Esrey, "Water, Waste and Well Being"), the timing and extent of black stature increase predates the installation of city and municipal water treatment and waste disposal facilities. Troesken, *Water, Race and Disease*. See Haines, Lee and Weiss, "The Short and the Dead" for a discussion on the significance of disease in biological processes. Troesken, , *Water, Race and Disease*.

[35] Breeden, "Disease as a Factor in Southern Distinctiveness"; Troesken, "The Limits of Jim Crow." Higgs, , *Competition and Coercion*, p. 14, suggests that wherever blacks gathered after emancipation, epidemics of smallpox, typhoid fever and dysentery followed.

[36] Coclanis, and Komlos. "Southern Nutrition and Economic Development," p. 106.

[37] Kiple, Kenneth and Virginia Kiple, "Slave Child Mortality," p. 285; Steckel, Richard, "Work, Disease and Diet," p. 502.

[38] Kiple and Kiple, p. 286.

[39] Ibid. pp. 285, 287.

environments contributed to sub-standard biological living conditions among 19th century Southern blacks.

Figure 2's second general pattern is that both black and white adult average statures approximately varied with institutional change. Of white inmates born between 1830 and 1860, their average stature was nearly constant at 174 centimeters; however, during the 1870s, white average stature began a marked decline that never recovered.[40] This unique pattern indicates that whites in the Texas prison did not experience the antebellum paradox observed in other samples,[41] and that lower class white stature declines correspond approximately with the elimination of slavery. Nevertheless, sub-adult and adult secular trends may have responded differently to changes in biological living conditions and are now discussed separately.

Sub-Adults

The earliest that inmates in the Texas prison sample were recorded was 1873, at which time 15 year olds were born in 1858, and 20 year olds born in 1853. Figure 2 also demonstrates that the maximum black adult stature was achieved during the 1850s, making the 1850s the natural control group to compare sub-adult statures of blacks and whites. Five year interval birth binary variables are then used to control for birth period. Between 1850 and 1870, black sub-adult stature declined by over one centimeter. The most difficult period for black sub-adults was during the 1870s and Reconstruction, when the Southern economy was in disarray. Nevertheless, as black sub-adults in the late 19th

[40] Coclanis and Komlos, "Southern Nutrition and Economic Development," p. 105, find that the average stature among white students at The Citadel during the 1890s experienced noticeable setbacks. The Citadel students' average stature did not recover until nearly the 1920s. The late century was a period of extreme Southern economic distress, even among whites.

[41] Fogel et al, "Secular Changes"; Komlos, "Toward an Anthropometric History of African-Americans"; Bodenhorn, "A Troublesome Caste," and "Mulatto Advantage"; Komlos, "Antebellum paradox."

century more fully integrated into Southern labor markets, the physical conditions facing young blacks improved, and the statures of young blacks nearly returned to their 1850s levels.[42] Therefore, the secular trend among young blacks indicates that their biological living conditions declined after the Civil War but improved toward the end of the 19th century.

The adolescent stature of sub-adult whites compared to blacks indicates that racial disparity was prominent in 19th century Southern biological living conditions. Variation in the white sub-adult secular trend indicates that white youths, like black youths, experienced a sustained stature diminution immediately after the removal of slavery. However, while the average stature of sub-adult blacks began to recover at the close of the 19th century, the postbellum white sub-adult stature declined by over one and a half centimeters and never recovered. Lower class young Southern whites may have been even more adversely affected by the removal of slavery than blacks, likely the result of the increased competition from free black labor and an industrializing sector that disproportionately favored white labor. For example, preferences to employ lower class white labor inadvertently placed white sub-adult workers into cotton mills and manufacturing plants where disease was more readily transmitted, putting lower class whites at a biological disadvantage at the end of the 19th century. As the postbellum South industrialized, poor white workers found greater access to manufacturing jobs and

[42] After emancipation, competition between planters may have improved former slaves biological living conditions. After the War, planters faced constrained labor markets and blacks were free to migrate away from the South, suggesting that competition for black labor may have done as much for black biological living conditions as military force and government policy, Higgs, *Competition and Coercion*, pp. 26 and 49.

were employed as mill operatives, and perhaps for the first time were exposed to the deleterious aspects of industrialization.[43]

Adults

Table 2 also presents adult stature regressions, and it is the fluctuation in black adult stature that is most striking. Since more adults were born before and after slavery, changes in adult stature better reflects the consequences on stature of the institutional change from slavery to a free South. After controlling for compositional effects, black adult secular trends between the 1830s and the eve of the Civil War improved by two and one half centimeters. Between 1815 and 1860, cotton production and the demand for cotton increased;[44] increased antebellum demand for cotton and increasing Southern incomes likely transferred into improving biological living conditions for slaves.[45] In turn, the demand for slaves[46] and the real price of slaves increased during the early 19th century.[47] Moreover, between 1830 and 1850, average hog weights increased, suggesting that Southern access to animal proteins was increasing.[48] This may suggest in the Deep South that—while the biological living standards of slaves were clearly inferior to whites under slavery—were ironically improving relative to whites throughout much of the first

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[43] Woodward, *Origins of the New South,* p. 134; Margo, and Steckel, "Nutrition and Health," pp. 517-518, find that biological living conditions surrounding freedom improved the nutritional status of upper class whites.

[44] Fogel and Engerman, *Time on the Cross*, p. 90, Figure 25 and 26; Wright, *The Political Economy of the Cotton South,* p. 106. Cotton growth in the 20 years before the War was due to changes in crop mix.

[45] Wright, *The Political Economy of the Cotton South,* pp. 24, 80, 89, 102; Easterlin, "National Income Trends," p. 40; Soltow, *Men and Wealth,* p. 67, Table 3.2.

[46] Fogel, and Engerman, *Time on the Cross,* p. 87, Table 24.

[47] Still another source of improving slave conditions between 1820 and 1850 may have been the nature of 19th century slave law. Over the course of the antebellum period, southern courts became increasingly efficient at assigning property rights, liability and making information transparent between slave traders. Southern court decisions gave slave owners greater judicial incentive to care for their slaves. Wahl, Jenny, "Jurisprudence of American Slave Sales."

[48] Cuff, "Pork Production," p. 61.

half of the 19th century.[49] However, once the institutional arrangement changed from slavery to freedom, the biological consequences on adult black stature were significant, with black stature declining to comparable 1830s levels. By the mid-1880s, the average stature of adult blacks declined by nearly one centimeter, only to recover by over one centimeter at the end of the 19th century, despite economic disruptions and increasing physical violence from whites.

The secular trend in adult white stature declined throughout the 19th century. The abolition of slavery and the advent of the sharecropping system exposed lower class adult whites to greater competition from freed blacks in Southern labor markets or were employed in hazardous work environments, translating into biological disamenities and deteriorating living conditions among the white working poor. Consequently, antebellum Southern adult stature declined similar to other white samples,[50] and Reconstruction did not improve white adult biological living conditions.

IV. The Comparative Effects of Socioeconomic Characteristics on Black and White Stature

Sub-adults

Given their recent entries into the adult labor force, robust adolescent black stature gains by age are not surprising. Many young black male slaves and sharecroppers sought to escape the meager diets of childhood by entering the Southern labor force as soon as they were able.[51] However, young blacks' age, inexperience and the lack of access to the institutions that facilitated their acquisition of skills limited their advance into white-collar and skilled occupations. Nevertheless, it is clear that young black field

[49] Rose, "Biological Consequences of Segregation"
[50] Sokoloff and Villaflor, "Early Acheivement," p. 463.
[51] Steckel, "A Peculiar Population," p. 740.

hands were taller than young blacks in other occupations.[52] Under slavery, overseers may have selected stronger, taller slaves to work their plantations. Under sharecropping, white Southern landowners may have more willingly tenanted to taller, stronger blacks, extracting a signal from their physical stature as to their agricultural productivity.[53] For the most part, there were few regional stature differences among young black males. Contemporary reports of rickets and kwashiorkor in the Northeast did not significantly reduced the stature of Northeast black youths incarcerated in the Deep South.

The average stature of 19th century young Southern whites was taller than the average stature of young Southern blacks, and there was little discernible difference in stature gains after age 16 between young blacks and whites. Like black youths, the recent entry of young whites into Southern labor markets prevented their acquisitions of skills, limiting young whites from entering white-collar and skilled occupations; however, young white agricultural and unskilled workers were significantly taller than young white workers in other occupations.[54] Young white farmers, farm laborers, and stock raisers worked and lived in rural locations, increasing their access to nutrition and reducing their exposure to disease. Unlike black youths, we can be reasonably certain that taller white youths in agriculture and unskilled occupations was due to the ready access to conducive biological conditions or more physically able whites selecting into physically demanding agricultural occupations. Moreover, unlike the stature of black youths, the stature of young whites significantly varied by nativity. Southeastern and Southwestern white youths reached the tallest average statures, indicating that while sub-

[52] Margo, and Steckel, "Nutrition and Health of Slaves," p. 525.
[53] Metzer, "Rational Management," p. 134.
[54] Komlos and Coclanis, "Puzzling Cycle," p. 441; Steckel, and Haurin, "Midwester," p. 123; Margo and Steckel, "Native Born Whites," p. 170; Sokoloff and Villaflor, "Early Achievment," p. 463.

adult white stature diminished with emancipation, Southern white youths in the Texas prison were at a distinct stature advantage to their northerly-born counterparts.

Adults

Adult stature is less sensitive to the effects of deprivation during childhood; nevertheless, prolonged deprivation during formative years can have permanent effects on adult stature. Unlike sub-adults, adults had ample time to acquire sufficient human capital to be meaningfully considered as white-collar and skilled workers. Black skilled and agricultural workers were taller than black white-collar and unskilled workers. As rural farmers and field hands, adult slaves and sharecroppers benefited by closer proximity to adequate diets and reduced exposure to disease. Black skilled workers— or their parents— may have themselves been the recipients of a plantation system that disproportionately rewarded skilled workers with rewards, greater access to nutrition, and perhaps less physically strenuous work requirements. Thus, part of the adult black skilled workers' stature advantage may be a residual of a plantation rewards system and work environments that accrued to themselves and their parent's plantation status, obfuscating the typical pattern where self-sufficient farmers attained the tallest statures.

Black adults from America's Plains and Southwestern states likely had better access to nutrition and animal proteins, reaching taller terminal statures than blacks from other regions. Moreover, blacks in America's Southwest were not exposed to the dire disease environment that existed in the Southeast. America's Southwest is an arid, dry climate with limited exposure to free and standing water, and proximity to water with accompanying malaria, yellow fever, and dysentery disease vectors that adversely effect

stature and health.[55] Moreover, in the Deep South, effects of migration on black adult stature may reflect the antebellum slave trade, where traders sold taller, more physically able slaves into the lower South and Texas, although Komlos and Alecke show that the relationship between migration and stature was small.[56]

Adult whites recorded as white-collar and skilled workers generally reached taller average statures than their black counterparts. Like other 19th century white American samples, it was planters and stock-raisers within the Texas prison that reached the tallest terminal statures.[57] Although there is evidence that poor Southern whites practiced subsistence agriculture on marginally productive lands,[58] 19th century American economic prosperity was tied to land access, and white planters and stock raisers had greater access than blacks to land and wealth.[59] Unskilled white workers were also surprisingly tall, which may reflect benefits from rural locations or biologically successful unskilled workers being selected by employers for more physically demanding unskilled occupations. Finally, nativity among lower class adult whites in the Texas sample coincides with other 19th century samples: the biological standard of living among Southeastern adult whites met or exceeded whites from other regional areas.[60]

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[55] Haines, Lee and Weiss, "The Short and the Dead;" Troesken, *Water, Race and Disease*, pp. 26-29, Figures 2.1, 2.2, 2.3, and 2.4.
[56] Margo and Steckel, "Heights of American Slaves," p. 527; Pritchett and Fruedenberger, "A Peculiar Sample."
[57] Komlos, "Stature and Nutrition in the Hapsburg Monarchy," pp. 1149-1161. Fogel, " Nutrition and the Decline in Mortality since 1700," p. 500; Margo and Steckel, "Heights of Native Born Northern Whites," pp. 171-72. Margo, and Steckel, "Nutrition and Health of Slaves and Southern Whites," pp. 517-518, find that white farmers and professionals were relatively tall. Slave field hands were taller than slave servants by one centimeter.
Margo and Steckel. "Heights of Native Born Northern Whites," p. 172.
[58] Reid, Joseph, "Sharecropping," 34.
[59] Soltow, *Men and Wealth,* p. 100; Atack, and Bateman, *To Their Own Soil, p.* 93, demonstrate that blacks in the Antebellum North held significantly less wealth than whites.
[60] F-restrictions on white age, occupations, birth cohorts and nativity are all significant at .01.

V. Discussion

The biological living conditions facing blacks and whites between the Civil War and the end of the 19th century were clearly different. While the antebellum biological conditions facing blacks relative to whites were inferior, they were ironically improving. Black stature increased throughout the antebellum period but declined after the Civil War. During Reconstruction, black statures recovered toward the end of the 19th century, despite increasing physical violence from whites. On the other hand, sub-adult white stature was roughly constant throughout the antebellum period but was adversely affected by the removal of slavery, suggesting that lower class whites were adversely affected by the elimination of slavery and Reconstruction. Multiple explanations that reflect distinctively Southern institutions emerge as possible reasons for black and white stature variations. These explanations center around two central themes: declining Southern wealth and agriculture, and disease environments. Before the Civil War and emancipation, the South—especially the lower South—was among the wealthiest regions in America and nearly self-sufficient in food production, and self-sufficiency enhanced biological living conditions.[61] After the War, the South was no longer self-sufficient in food production and experienced a sustained decrease in basic food production, which persisted throughout the second half of the 19th century.[62] Moreover, with the destruction of more than one third of the South's stock of hogs, a vital source of animal protein, the Civil War itself may have contributed to Southern stature declines.[63] After 1872, there

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[61] Ransom and Sutch, *One Kind of Freedom,* p. 156; Komlos and Coclanis, "Puzzling Cycle," p. 441; Steckel, and Haurin, "Midwest," p. 123; Margo and Steckel, "Heights of Native Born Whites," p. 170; Sokoloff and Villaflor, "Early Achievement," p. 463 for European and American stature cycles.

[62] Ransom, and Sutch. *One Kind of Freedom,* p. 153.
Wright, *The Political Economy of the Cotton South,* p. 164; Fite, "Agricultural Trap," p. 41.

[63] Wright, *The Political Economy of the Cotton South,* p. 164. After the Civil War, the South continued to lose livestock through a series of animal epidemics—especially equine glanders and hog cholera—which

was a persistent downward trend in hog weights, which lasted through 1900.[64] During Reconstruction, corn yields declined and higher corn prices made feeding hogs relatively more expensive, making less pork available for consumption.[65]

The second explanation for the decline in Southern agriculture suggests that the sharp decline in per capita Southern agricultural output after the War was partially the result of disease. Specifically, hookworm may have been responsible for part of the decline in Post-bellum Southern agricultural output and biological living conditions.[66] Moreover, the disproportionate increase in black stature at the end of the 19th century may be evidence that American disease environments disproportionately affected blacks.[67] However, the timing and extent of black stature gains at the end of the 19th century do not favor a disease-only explanation for black stature gains. While most cities received water lines and sewer treatment facilities by 1899, most Southern blacks were rural, and black stature increases predate the installation of public water and sewage treatment facilities to rural blacks.[68] On the other hand, black stature increases in the Texas prison coincide with increased antebellum wealth and prosperity; black stature decreases coincide with decreased Reconstruction wealth, decreased access to foodstuffs and widespread postbullum disease. Consequently, late 19th century variation in biological living conditions for both blacks and whites were the result of the complex

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killed thousands of horses and pigs. The Civil War destroyed one-third of Southern horses and mules, further reducing Southern agricultural productivity, Woodward, *Origins,* p. 177.

[64]Wright, *The Political Economy of the Cotton South,* p. 62.

[65] Cuff, "Pork Production," pp. 61-62.

[66] Brinkley, "The Decline in Southern Agricultural Output," pp. 125-136; Bleakley, "Disease and Development." Moreover, disease insults may have disproportionately accrued to the South's black population. Wherever blacks concentrated after the War, epidemics of smallpox, typhoid fever and dysentery were prominent.

[67]Troesken, *Water, Race and Disease.*

[68] Ibid. 26-29, Figures 2.1, 2.2, 2.3, and 2.4.

relationships between diets and disease, but after 1880, stature gains disproportionately accrued to African-Americans.

Appendix

Texas Occupations

White-Collar

Accountant	Actor	Agent	Architect
Attorney	Baker	Barber	Butcher
Clerk	Druggist	Electrician	Engineer
Nurse	Physician	Minister	Salesman
School Teacher	Telegraph Operator		

Skilled

Blacksmith	Boiler Maker	Brick Layer	Carpenter
Cigar Maker	Harness Maker	Machinist	Mechanic
Merchant	Molder	Plumber	Printer
Shoe Maker	Stonecutter	Tailor	Tinsmith
Weaver	Wheelwright		

Farmer

Cattle Rancher	Dairy Man	Farmer	Stockman

Unskilled

Apprentice	Bar Keeper	Boot Black	Brakeman
Cook	Cowboy	Fireman	Gambler
Herder	Hostler	Housekeeper	Laborer
Miner	Porter	Railroad Laborer	Servant
Soldier	Teamster	Waiter	

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